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# Larvae for layers

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**Companies and researchers are in close collaboration developing a container-based system for cultivating fly larvae at organic poultry farms.**

**In a one week process, manure will be converted to compost and the live larvae will be harvested and used for feeding laying hens. The larvae are expected to have a beneficial effect on the growth performance, intestinal health and on animal behavior in flocks.**

In the Organic RDD project "BIOCONVAL" (biological conversion to value), Danish Technological Institute, DTU Food (National Food Institute), Aarhus University and the Knowledge Centre for Agriculture (Poultry) are cooperating with the Danish companies EWH BioProduction and Farmerødning and the Dutch company Dorset Green Machines as well as an organic Danish egg producer.

The aim is to develop and demonstrate an integrated system for cultivating fly larvae (*Musca domestica*) in poultry manure locally at the farms, and subsequently to use them as dietary supplement for the hens. The fly larva is very nutritious and is a natural food source for poultry. It has an amino acid composition that is similar to fishmeal and is especially rich on the essential amino acids methionine and Cysteine. Among laying

hens, the lack of methionine may lower the production and may possibly lead to feather picking and cannibalism, a problem often seen in organic farming.

Feeding live larvae could help overcome these problems, and additionally is hypothesized to increase gut health and animal welfare and behavior.

## Cultivation in manure

The larvae have an amazing ability to convert fresh manure to compost in very short time. Before they pupate they empty their intestine, allowing clean larvae to be collected and the remaining compost to be used as valuable fertilizer. However, many factors influence the cultivation of high-quality larvae, e.g. the compost temperature, the dosage of fly eggs, humidity in the substrate etc. Therefore, a number of prototype tests have been carried out at Danish Technological Institute in order to optimize the system before it can be used at the chicken farm and supply the hens with fresh larvae.

The solutions have now

been implemented in a machine from the Dutch company Dorset Green Machines. The company has already developed equipment for manure treatment and part of this technique has been used in a new container system for larvae cultivation.

The final concept in the BIOCONVAL project will -after a test period -be demonstrated at an organic farm located near Brande.

## Dietary and behavioral impact of larvae feeding

Before implementation on the farm an 8 week comprehensive feeding trial will be conducted in May-June at the research stables at AU Foulum. In the study, larval meal as a protein source will be evaluated against fishmeal, and furthermore a group of layers will also receive fresh larvae grown on manure. Here the impact of larvae feeding on growth and gutflora composition will be investigated, as well as behavioral studies including feather picking and cannibalism. In earlier experiments we have observed that chickens are very



*Fly larvae on an electronic scales.*





Thousands of fly-eggs



## The BioConVal consortium consists of:

E.W.H. Bioproduction Aps ([www.bioproduction.dk](http://www.bioproduction.dk)); produce and deliver fly eggs for the project  
 Dorset Green Machines B.V. ([www.dorset.nu](http://www.dorset.nu)); design and production of container for the larvae production  
 Farmergodning ([www.farmergoedning.dk](http://www.farmergoedning.dk)); composting experiments, organic fertilizer expert  
 Organic egg producer Jan Volmar; on farm trial with larvae feeding of organic layers  
 Technical University of Denmark, National Food institute ([www.food.dtu.dk](http://www.food.dtu.dk)); laboratory infection models, risk evaluation, feed trial and gutflora studies  
 Knowledge Centre for Agriculture ([www.vfl.dk](http://www.vfl.dk)); design of farm trial, feed formulation, welfare  
 Aarhus University, Institute for Animal Science- Immunology and microbiology ([www.agrisci.au.dk](http://www.agrisci.au.dk)); larvae feed trial, production data  
 Danish Technological Institute ([www.teknologisk.dk](http://www.teknologisk.dk)); optimization of production and isolation of larvae, project management

interested in searching and eating insects.

### Microbiological safety

As the fly larvae are developed in poultry manure, which contains a lot of bacteria, it is also important to ensure that the larvae do not contribute to propagate and transfer infectious matter from the manure to the hens.

In previous studies, the larvae have been heat-treated or made into larvae meal in order to avoid transfer of infections. However, in order to stimulate the hens as much as possible they have to be served to the hens alive and fresh. To ensure that the hens are not exposed to any risk from enteric pathogens as *Salmonella* or *E. coli*, researchers

from DTU Food (National Food Institute) are investigating how the decomposition of the manure by the larvae influences pathogenic bacteria.

The results of these studies are very promising as the larva increases the natural inactivation of the tested pathogens in the manure and inside the larvae itself.

### Against the EU feedstuff legislation

Although organic layers already eats a lot of natural insects in the free range stables, the use of insects for feeding animals are not allowed in the EU. As a reminiscence of the BSE outbreak in the early nineties, strict rules are regulating which sources that may be used for feed and for the mo-

ment insects are not among these. There is an increasing demand for lifting this ban on insects, and one of the purposes of this project is to show that fly larvae are safe to use as a feed. It is therefore encouraging that processed fly larvae will be allowed for feeding framed fish in the EU in 2013. We see this as an important step in the right direction.

### Perspectives

Larvae bioconversion systems have been proposed as a high quality, efficient and sustainable protein source used as feed or as a direct food source for both animals and humans. Poultry manure is just one of many possible substrates that larvae can convert into high-value protein. Today,

large amounts of household and industrial waste are solely used for energy purposes, but protein of higher value could be extracted before the rest is used for energy.

Large scale production of larvae requires however a very high amount of fly-eggs, because the weight of each larvae is small. In order to propagate larvae bioconversion the production of fly-eggs must be automated and made more efficient. This aspect will be further examined in by the project group in the near future.

Organic hens



### More information

Read more about the Organic RDD project EcoServe at: [http://www.icrofs.dk/Sider/Forskning/organicrdd\\_bioconval.html](http://www.icrofs.dk/Sider/Forskning/organicrdd_bioconval.html)



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